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Conservation Guidance for Species in Greatest Need of Conservation (SGNC).

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Annual Report

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Goals/ Objectives:**(1).** Engage IDNR staff and other stakeholders to identify conservation guidance needs; **(2).** Develop a consistent process for assembling conservation guidance documents for state-listed species that complements the IWAP; **(3).** Develop a series of conservation guidance documents for SGNC that are frequently subject to ITA requests; **(4).** Design a conservation plan form coordinated with the species guidance documents, to be used by project developers in planning to reduce development impacts to state-listed species/SGNC for Incidental Take Authorization (ITA).

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Narrative:
Interview questions were designed and Internal Review Board approval was acquired. Interviewees were identified, contacted, and consent obtained. Eleven interviews were completed, transcribed, and analyzed. Conservation planning documents have also been compiled and analyzed. We continue to work with IDNR staff on the review of incoming conservation plans and development of Incidental Take Authorizations.

Using the information collected, the conservation plan template and the species guidance document template have been created and are being pilot tested. draft species guidance document for Illinois chorus frog has been compiled from primary literature and IDNR documents. A list of knowledgeable practitioners and scientists was compiled and the Illinois Chorus Frog document was sent out for stakeholder review and comment. A draft species guidance document has been prepared for Blanding's turtle and is under preliminary review by the Blanding's turtle working group. A list of practitioners, scientists, and stakeholders to review the document is being compiled. The species guidance document template was used to guide document development and is being refined in the process. The Endangered Species Program is actively using the conservation plan template and the template is being revised as needed. These templates will continuously be improved during the project.

In addition, the Endangered Species webpage that will hold the species guidance documents has been built and placeholder links to INHS species pages have been created. The Incidental Take Authorization webpage has been revised to include past ITAs and conservation plans. The conservation plan template has also been posted.

Preliminary findings were presented to academic peers at the International Symposium on Society and Resource Management. Results included the need for scientific information, the need to formulate research questions, and the need for a structured approach to elicit expert judgements. Also, while at the conference training was received on Structured Decision Making, a technique that will be incorporated into the conservation planning and ITA process. We have also built interest in the project through a presentation at a regional fisheries conference. We identified additional taxa experts, who are developing guidance documents for bats, mussels, and fish, for which we will be coordinating the review and revision. A survey has been sent to IDNR practitioners to assess their preferred source of information and responses are currently being collected.

Job 1. Plan and prepare for stakeholder research.

Interview questions were developed to elicit stakeholder experiences and needs surrounding endangered species consultation and incidental take authorization. We applied for and received approval of the research protocol by the University of Illinois Internal Review Board. Interview questions were pilot tested with one interviewee and revised to streamline the interviews. Twelve (12) interviewees were contacted and 11 gave consent to participate in the research. Approved interview questions can be found in Table 1.

Job 2. Review conservation planning documents and conduct discourse analysis (Gee 1999). Incidental Take Authorizations, Conservation plans, and Consultation Letters are all documents that play a role in conservation planning for listed species. Consultation Letters are prepared by the IDNR Environmental Review section to inform project developers of sensitive natural resources they are likely to impact based on the project footprint submitted to IDNR. Project developers may prepare a Conservation Plan as an application for Incidental Take Authorization. IDNR writes an Incidental Take Authorization document to allow project developers to 'take' listed species. Obviously, these documents play different, but related, roles, but it is important that they work from a common understanding of the species and its needs-the type of information species guidance documents will provide. To identify the types of information that would be most useful in species guidance documents, we collected data from Consultation letters, Conservation Plans, and Incidental Take Authorizations.

Conservation plans, Incidental Take Authorizations, and consultation letters were gathered from eight development projects that were determined likely to have impacts on listed species. Projects were selected to represent different types of activities (bridge replacement, water line, transmission line, alternative thermal standards, drainage channel relocation, road improvements, barge dock, and wind power operation) and different types of applicants (state government, local government, private industry, and public utility). All projects were authorized in 2014 or 2015 and had all documents available.

Themes related to conservation planning for listed animal species were identified and extracted from the documents. The program Atlas.ti was used to code the documents using grounded theory to allow codes to emerge from the documents (Strauss and Corbin 1990). Consultation letters, Conservation Plans, and Incidental Take Authorizations were compared to identify similarities and differences in conservation planning and species guidance needs. Concepts that emerged from the analysis are described below (codes are underlined for easy identification). They are broken into two parts: elements with potential to be included in species guidance documents and concepts that should be incorporated into the conservation plan template.

Information about a species life history is necessary for planning and evaluating the impacts of a project. This type of information was included in 25, 67, and 63 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively. The amount of

information included varies considerably from a single sentence to pages of description. This information included things like diet, reproductive cycles, and seasonal movements, often focusing on when and where certain activities take place. For example, "It is usually only seen above ground during the spring breeding season (February – April); they prefer to be below ground from May to January. The species hibernates in burrows, and breeds in flooded fields, ditches, and vernal pools." The timing of species' life events (phenology) and the spatial delineation of species movements, in particular, can greatly improve conservation planning efforts. Completing work when the species is not present or at an appropriate distance from certain habitat attributes can greatly reduce impacts. Information on phenology was included in 25, 56, and 25 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively. Information on species movements was included in 13, 22, and 13 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively. A physical description of the species was included in 28% of the documents.

Species abundance is notoriously difficult to assess for rare species, yet information on population size is very important for understanding the severity of an impact to a population. Unfortunately, the only information available is often based on the number of coincidental observations. Some 50, 89, and 100 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively, contained some form of statement about the abundance of the species. Species abundance is often explained in vague terms, such as "large numbers", "abundant", "collected twice", or "occupied". Some documents contained estimates of take based on survey results or best guesses. Incidental Take Authorizations often contained information on the statewide number of Element Occurrence Records (populations) from the Natural Heritage Database. Some documents provide the year that the species was last observed as an indicator of abundance. Twenty percent of documents suggested surveys to better understand species abundance and forty percent of documents describe surveys that were conducted specifically for the project.

Information on species distribution on a large scale is readily available via organizations such as NatureServe or IUCN, yet information on local distribution can be spotty. Most of the documents reviewed mentioned the overall range of the species, the counties it has been observed in, or more specific location information, such as "along the toe of the river bluffs." Some form of distribution information was included in 25, 67, and 88 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively. Information on habitat characteristics can be important for understanding species distribution on a more local scale to better evaluate potential impacts to a species. Furthermore, information on habitat characteristics are essential for providing conservation benefit. Habitat information was described in 25, 78, and 100 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively. Descriptions included information on the natural community, specific host species, habitat structure, and/or abiotic factors, such as soil type, stream flow, or temperature.

Information on threats to a species survival in general, and information on specific threats due to project impacts can be useful in evaluating project plans. General threats were discussed in 13, 67, and 88 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively. General threat statements varied from providing information on major to minor threats to the species, such as habitat loss, invasive species, and pesticide use. Incidental Take Authorizations provided information on the types activities that have received Incidental Take Authorization in the past. Information on specific impacts of a project to a species varied from general statements that the project may impact the species to specific statements on the form of impact including loss of habitat, reduced recruitment, and direct mortality due to vehicle traffic or crushing. Information on project impacts was included in 63, 89, and 100 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively.

Avoidance measures are an important part of conservation planning. These measures include reducing or relocating the project footprint. However, these measures are only discussed in 13, 44, and 38 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively. This may be due to the late stage at which environmental impacts are sometimes considered in the planning process. Some statements described the difficulty of avoiding impacts do to the wide ranging movements of the species.

Minimization measures are another important part of conservation planning. The importance of these measures to conservation planning is obvious in their prevalence in 50, 100, and 100 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively. Minimization measures from Consultation Letters included educating site personnel about the sensitive species and seeking an Incidental Take Authorization to incorporate species needs into project plans. Minimization measures included in Conservation Plans and Incidental Take Authorizations were more numerous, including limiting project activities to less sensitive seasons, educating site personnel, altering project structure/operation to incorporate species needs, relocating or excluding the species from the project site, erosion and sediment control, and preventing the spread of invasive species.

Mitigation measures are another important part of conservation planning. These measures are incorporated into planning later than other measures as is evident in their inclusion in 0, 78, and 100 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively. These measures include activities that are taken to compensate for the impact to the listed species by providing some form of conservation benefit. Mitigation measures included habitat restoration/improvement, compensatory payment, forming a conservation partnership, species research, species propagation, host species propagation, and invasive species management.

Monitoring is important for understanding the impacts of a project on a species. Similar to mitigation measures, monitoring often does not appear in early planning documents. Information on monitoring is included in 0, 67, and 100 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively. Monitoring activities can target either the species directly or the minimization measures. Monitoring efforts detailed in the documents included pre-construction species surveys, species relocation surveys, presence-absence surveys, habitat monitoring, host species monitoring, post-construction species monitoring for 1 or more years, monitoring the implementation of minimization and mitigation measures, or no monitoring required. Most of the requirements appear very inconsistent and inappropriately designed to determine impacts. Some monitoring is tied to adaptive management triggers.

Information on regulations that apply to the species can prove useful in fulfilling legal requirements related to conservation planning. It is not surprising that all of the documents mentioned regulations as they applied to the project or species. The wide range of regulations that were relevant to conservation planning was surprising though. Some regulations applied specifically to endangered species, while others were relevant to other aspects of the projects. Information on regulations included US laws (Endangered Species Act, Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, National Environmental Policy Act, Clean Water Act, Nuclear Regulatory Commission, Fish and Wildlife Coordination Act, National Historic Preservation Act, Archaeological and Historic Preservation Act, River and Harbors Act), state laws (Illinois Endangered Species Protection Act, Illinois Interagency Wetland Policy Act, Illinois Natural Areas Preservation Act, Illinois Human Skeletal Remains Protection Act), and local laws (county floodplain development permit)

In addition to these elements, which can be incorporated into species guidance documents; there are a number of other elements that were recognized as important for inclusion in the conservation plan template. These elements are more procedural in nature and not specific to species; therefore they are more appropriate for the conservation plan template than for conservation guidance documents.

Adaptive management is described as a way to make decisions in the face of uncertainty by monitoring the uncertain element over time and adjusting to the new information. To be useful, adaptive management requires identifying objectives and uncertainties, thinking through a range of potential outcomes, developing triggers that will lead to different actions being taken, and monitoring to detect those triggers (Nie and Schultz 2012). Some form of adaptive management statement is included in 0, 67 and 50 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively. Unfortunately, the adaptive management included in these documents is frequently poorly conceived, as it fails to identify uncertainties, potential outcomes, triggers, and monitoring actions. Most documents include little more than statements such as, “If an unforeseen circumstance that affects the effectiveness of the measure instituted to

minimize or mitigate the effects of the proposed action on the chorus frog the job will shut down until the owner can consult with IDNR to further discuss the situation and their options." However, other projects, specifically wind power, have well defined uncertainties, triggers, and monitoring actions, perhaps due to the ongoing nature of the take.

Consideration of alternative actions is an important tool in conservation planning as it allows for thinking of other options and evaluating the potential outcomes in terms of all relevant objectives. However, to be useful it requires creativity and systematic analysis. Alternative actions are mentioned in 0, 89, and 25 percent of Consultation Letters, Conservation Plans, and Incidental Take Authorizations, respectively. Alternatives considered varied greatly from considering different locations to considering different structures. Although some documents use multiple objectives, such as natural resources, listed species, cultural resources, and costs, to evaluate alternatives, others limited their objectives considerably to safety or costs.

This job was completed to identify conservation guidance elements that are frequently used in Consultation Letters, Conservation Plans, and Incidental Take Authorizations. Elements that have been identified for inclusion in species guidance documents include: species' life history, movements, phenology, abundance, distribution, habitat characteristics, threats, project impacts, avoidance measures, minimization measures, mitigation measures, monitoring, and regulations. In addition, instruction on developing adaptive management and alternative actions should be incorporated into conservation plan templates to improve these procedural elements.

Job 3. Conduct interviews of stakeholders and analyze transcripts using discourse analysis. Conservation planning for listed species involves numerous processes and stakeholders. Species guidance documents should provide information that is useful across the range of stakeholders. To better understand the conservation guidance needs of stakeholders, we conducted interviews with individuals involved in the Environmental Review/Incidental Take Authorization process.

Eleven semi-structured interviews were conducted with stakeholders from the IDNR Environmental Review Section (5), the IDNR Endangered Species Program (1), other state agencies (3) and private consultants (2). Open-ended interview questions developed under Job 1 were used to direct the conversation; a sub-set of the interview questions with more general applicability were used for stakeholders outside IDNR. Interviews were recorded and transcribed. Grounded theory analysis was used to allow codes to emerge from the text (Strauss and Corbin 1990). The program Atlas.ti was used in coding and analysis of the transcripts. Themes related to species conservation guidance were identified and extracted from the coded transcripts. Below is a description of the main concepts discussed including overall thoughts on the conservation planning process, specific elements to include in guidance documents, and guidance for conservation plans.

General process insights

In general, interviewees described a good review as having two elements: reducing the impact to the species and allowing the project to move ahead. They believed the strengths of the review process were communication, cooperation, and coordination, both among reviewers and with project developers. A few interviewees described how important it was to be able to have face to face meetings to discuss projects and species to identify concerns and provide recommendations and guidance. Some interviewees thought this open dialogue was really important for identifying issues early, adjusting for them, and avoiding time delays. Another interviewee suggested the standardized documentation of the process was important for providing clarity throughout the process.

Interviewees described bad environmental reviews as those involving conflicting interests, political influence, uncertainty surrounding impacts/practices, or underfunded project developers, who cannot afford to implement recommendations. Overall, interviewees thought the process was a good one, yet a variety of weaknesses were identified. Some interviewees suggested the process needs to be easier, faster, or more stream-lined. For example, regulations around mussel relocation require mussels to be located twice, which is considered overly burdensome. Another weakness was a lack of coordination, especially when multiple stakeholders were involved, such as federal and state agencies. Interviewees suggested unexpected changes that occur late in the planning process are a challenge to project developers and an informed public. One interviewee suggested, the scope of the review is too narrow, ”We need to be looking at habitat destruction in a more comprehensive fashion and not just focusing on listed species.” Interviewees also suggested that IDNR staff workloads are too large and are a challenge to the process.

A frequently mentioned challenge was the limitation of the available information. For example, IDNR does not provide clear instruction and guidance to project developers. Also relevant information about the species and project impacts could not be found all in one place. Limitations included spatial and experiential information; one interviewee said, “We just don’t know that much about where [listed species] are”, while another explained their understanding of a project was limited by not seeing it in-person. In addition, limited follow-up monitoring for some projects means information availability does not improve regarding species or the effectiveness of conservation practices. One interviewee explained he would like to have evidence for their recommended measures, but he often needs to give recommendations based on his best judgement.

Interviewees suggested they have a fair amount of discretion in their work, though administrative rules set constraints and science provides some guidance. One interviewee described what they do as, “a science-based art.” One interviewee explained that species information is so variable that different recommendations may be made, while another interviewee explained that reviews

vary depending on the "conviction" of the reviewer. Despite this variety interviewees suggested that consistency is important. Interviewees described using their past experience and group norms to provide consistency. One interviewee explained, "We have the resource of looking back at how other people have dealt with similar situations." Another interviewee said, "We will use, for our templates, recent ITAs, you know fully executed ITAs, so we know, well that one passed inspection with DNR, so it must be alright."

Elements for documents

Interviewees identified multiple elements that should be included in species guidance documents. First, basic species information is required to understand the species needs. Interviewees explained that sometimes this information is not known for rare species. Interviewees mentioned basic species information including habitat requirements, diet, reproductive cycle, and behavior.

Second, information about how species are potentially impacted by development projects is needed. This information consists of both species sensitivity and project hazards. Information on species sensitivity includes sensory ecology, or what the species perceives including noise, chemical, and light pollution. Interviewees also pointed out that information on reproductive cycles and activity patterns can improve understanding of what stage or time the species is most sensitive. This information is related to identifying date restrictions that should be placed different types of activities in different locations. Temperatures restrictions were also discussed but were considered impractical for project developers to manage. Interviewees discussed needing information on avoidance and minimization measures for development activities and information on the effectiveness these measures.

Third, information on conservation opportunities is needed to guide conservation efforts. Interviewees described wanting to benefit the species through conservation actions, such as those required for mitigation. Identifying mitigation/conservation projects requires considerable effort and coordination. Partnerships were mentioned as providing useful opportunities for mitigation, and potential partner organizations can be identified in guidance documents.

Fourth, guidance on monitoring protocols will improve the information collected on the species. Interviewees suggested that current monitoring efforts do not provide enough information and that survey efforts should be more standardized and comparable.

Fifth, identification of information gaps or research needs is necessary to guide research to fill these gaps. One interviewee suggested that researchers do not know the questions regulators have and that these questions should be identified on guidance documents. These gaps largely consist of uncertainties in the previous four elements. Interviewees described information gaps in habitat requirements, species distribution, population size, habitat restoration methods, best

management practices, and impacts of hazardous waste, chemicals, air quality, and traffic noise on species.

Sixth, scientific references that support or justify actions need to be identified. Some interviewees explained that documentation was important for their work so they could justify their decisions. One interviewee explained, “I always try to get the best scientific documentation on what is on the project, because whatever decision I make professionally on a project, whether it is a small project or a large project, I want to be able to go to court and defend my decision and I want to have the scientific documentation to back me up.”

Seventh, additional sources of information should be included on guidance documents. Interviewees mentioned using numerous sources of information in conservation planning. Many of the sources provided spatial information, such as the Illinois Natural Heritage database, National Wetland Inventory, topography, current and historical aerial imagery, soil maps, and Bing/google maps. Interviewees also mentioned primary scientific literature, reports from site surveys, species guidance documents provided by Missouri or Wisconsin, or other information found online. All interviewees described obtaining information and guidance from experts, such as IDNR staff, USFWS staff, consultants, or academic researchers, especially Illinois Natural History Survey.

Guidance for conservation plans

The handling of uncertainty is a challenge that should be addressed in the conservation plan template. As previously described, uncertainty was a frequently mentioned issue as there is a lack of information on the species in general and the project impacts in particular. Numerous interviewees mentioned that they themselves are not experts. “My lead into most conversation is that I am an expert in none and jack of all. “ One interview explained, “There are too many things to be an expert in.”

Interviewees had different ways of dealing with uncertainty. Some interviewees explained that they just have to accept uncertainty, “We live with it” and “You deal with it… you get your information and you make a decision. I don’t know what else to tell you.” Other interviewees explained that they use the precautionary principle and always try to error on the side of estimating greater impact saying, “Estimating take is always a breathtaking experience for me. It’s tough, so I always estimate on the high side and that way I figure we are covered.” One interviewee explained that he managed uncertainty by trying to anticipate uncertainties and by providing some flexibility in planning.

Most commonly interviewees mentioned that they relied on experts to deal with uncertainties. One interviewee explained, “I will turn it to an expert and rely on their opinions.” The experts commonly referred to were IDNR biologists, Illinois Natural History Survey scientists, and US

Fish and Wildlife Service biologists. Experts were very highly regarded, as one interviewee explained, “We rely on them. They are experts. They have been there…. The Illinois Natural History Survey is regarded statewide and nationwide and internationally with some taxa and some species as the experts. So we don’t have any qualms.” Some interviewees mentioned treating expert opinions with caution because it could be based on anecdotal evidence or research. One interviewee explained, “I am not sure how they are getting that information. Sometimes it a best guess, maybe. “

The identification and treatment of uncertainty should be addressed in conservation plans. A template will be able to guide applicants to indicate where there is uncertainty, place reasonable bounds around the uncertainty, and describe how they were determined. Monitoring surveys should then be targeted at reducing this uncertainty

Conclusions

Some of the challenges identified in interviews may be improved by conservation guidance documents. Species information that is synthesized and undergone stakeholder review ahead of time may improve coordination by increasing common ground, consistency, and predictability. In addition, species guidance documents may increase the quality of information used. The combination of being limited by the information available and being guided by group norms can be dangerous for species conservation (Morgan 2014). For example, ineffective recommendations could be made due to lack of information and those recommendations may gain credibility due to their repeated use despite having little supporting evidence. Although guidance documents are unlikely to eliminate uncertainties, they should be able to identify supporting evidence or a lack thereof.

Conservation planning for rare species is always difficult due to the uncertainty surrounding these species. Although it is impractical to expect species guidance documents to eliminate uncertainty, they may be able to provide ways to deal with it more productively. The uncritical use of expert opinion should be evaluated. Research has shown that expert opinion can be erroneous, especially under certain conditions, such as when they are not asked to indicate the bounds of their knowledge or when they become increasingly confident by repeating their opinion without receiving feedback as to its quality (Morgan 2014). By recognizing uncertainty, we will be able to target it to improve our information for future decisions (Martin et al. 2012).

One interviewee commented that he didn’t find research papers useful because he didn’t feel qualified to evaluate if the research was sound. He said, “What good does it do for me to read a research paper on something and one of my coworkers to read a research paper on that same species by someone else and that the information or the conclusions they arrive at are different? So there is then no consistency. I don’t know what is valid or good when it comes to what research paper I should pick and choose from. If people at higher levels wanted the research

papers to be used, and they said we will use this because we believe it to be valid with regard to this situation or this species or this resource, then that would be probably an optimal resource." This comment led us to further explore this topic with a survey that has been sent to IDNR practitioners to determine their preferred sources of information (Appendix 1). Responses are being collected.

Job 4. Identify elements necessary for conservation guidance documents.
Conservation guidance documents should include all elements that would be useful to different stakeholders. Document review (Job 2) and stakeholder interviews (Job 3) were used to improve our understanding of conservation guidance needs. In addition, participant observation with the Endangered Species Program and Blanding's turtle recovery team was also used to identify conservation guidance needs. Below is a list of the necessary elements with a description of what should be included.

1. Species characteristics
    a. Physical description of the species similar to description in a field guide with field cues. It should include key identification traits and how can you tell look-a-likes apart. It should include a photo or illustration.
2. Distribution, Taxonomy and Status
    a. Species distribution on a large scale is readily available via organizations such as NatureServe or IUCN and should be shown on a range map. Information on state distribution can be shown by mapping records from the Natural Heritage database; the point locations should be enlarged so as to conceal potentially sensitive information. If there are different winter and summer ranges this should be described. Do we know what limits their range?
    b. Some species will be divided into subspecies and differentiation should be described, physically and geographically. If the species has multiple scientific names proposed, describe them (See the Integrated Taxonomic Information System). Indicate which one is used by the Illinois Endangered Species Protection Board
    c. What is the global IUCN status of the species? What is the statewide status and why? If it is possible indicate local population sizes.
3. Habitat
    a. Description of habitat characteristics including biotic and abiotic factors. Describe the environment where the species has been found, including perhaps less than ideal environments such as those in Natural Heritage Database record descriptions. If known, habitat limitations should be indicated. Are there different habitat requirements at different life stages?
    b. If possible provide of map of a habitat model such as created by IDNR or from the USGS Gap analysis: http://gapanalysis.usgs.gov/species/data/download/.

4. Species biology
    a. Does the species migrate or move between habitats? When? Why? How far do they move (typical and maximum)? What is a typical, large, and small home range size? What effects home range size? Do they show site fidelity?
    b. What is the timing of various life events and how are they triggered?
    c. What is their reproductive cycle/system? Indicate when and where certain activities take place.
    d. How do they overwinter?
    e. Diet - What do they eat? Does it vary by life stage?
    f. What are the population dynamics? Indicate specific fecundity, recruitment, mortality, and longevity rates. Include population age and sex structure. What is the first age at reproduction? Have there been population viability studies? What life stage drives population trends?
    g. What is the natural community the species is commonly found in? What other species are often found with this one or are characteristic of the habitat where it is found. Do they exhibit inter or intra species territoriality? What are their predators/prey?
5. Species threats
    a. Include information on general threats to the species. If possible, indicate the significance of each threat. Consider threats such as habitat loss, invasive species, predators, parasites, diseases harvest, pollution (sounds, light, and chemical), etc. Include anticipated climate change impacts, which may be found in: "Adapting Conservation to a Changing Climate: An Update to the Illinois Wildlife Action Plan"
    b. Describe threats due to development project impacts. For example, is the species susceptible to road mortality, erosion, sedimentation, noise pollution, soil compaction, structure collision, shadow flicker, etc.
    c. Identify the types of impacts due to past INDR Incidental Take Authorizations. Information can be found in the IDNR ITA database.
    d. Provide information on species sensitivity, such as what the species perceives including noise, chemical, and light pollution.
6. Current conservation efforts
    a. What has been done to conserve the species? Describe current efforts such as recovery plans, land protection, propagation efforts, research projects, etc. Who is working on these projects?
    b. Goals- Have goals been identified for the species? Are there delisting triggers?
7. Monitoring and Survey guidelines
    a. Identify different survey objectives, such as determining presence/absence, estimating population size, evaluating project impacts, or assessing habitat. Describe specific methods and effort required for different survey objectives.

What are the detection rates of these survey methods? How much survey effort is required to acquire 90% confidence? How many years/sites need to be included in surveys? What is the best time of year to conduct surveys? Include references thet document methods

8. Stewardship recommendations
    a. How do you maintain or enhance habitat for this species? If prescribed burning is recommended include date or weather restrictions. What structure or dietary needs can to be managed for? Are there host species that should be increased? Are there specific metrics, such as water quality, that can be targeted? Are there invasive species and predators that may need to be controlled?
9. Avoidance measures
    a. How can impacts to the species be avoided? Describe habitat avoidance or other measures that are shown to be affective or may have merit. Note: Timing of habitat destruction will minimize impacts, not avoid them.
10. Minimization measures
    a. How can impacts to the species be minimized? Describe practices or timing that reduces impact to the species. If possible, provide information on the effectiveness of these measures. If possible, include estimated costs of measures.
    b. Identifying date restrictions for different types of activities in different locations, such as tree clearing or dewatering. Temperature restrictions may be more appropriate and should be described, yet they may be considered impractical for project developers to manage.
    c. Include practices from past ITAs, such as educating site personnel about the sensitive species, limiting project activities to less sensitive seasons, altering project structure/operation to incorporate species needs, relocating or excluding the species from the project site, erosion and sediment control, and preventing the spread of invasive species.
11. Mitigation and conservation opportunities
    a. Provide suggestions of conservation actions that will benefit the species. If a recovery plan has been developed, include the identified actions. Actions may include land protection, restoration, propagation, research projects, producing a recovery plan, or invasive species management. If possible, include estimated costs of various efforts
    b. Identify conservation groups that work in the area of the species that could be potential partners, including federal, state and local government conservation groups. Check the Prairie State Conservation Coalition website for land trusts. Request permission prior to identifying groups on the document.
12. Regulations

a. Identify regulations that apply to the species. This will likely be similar for most Illinois listed species. Describe ITA, possession permits, research permits, scientific collector permits, consultation, etc.

13. Research needs
    a. Most of the research gaps should be identified in researching the previous sections and can then be compiled here in the form of questions. Although there may be basic research questions about the species, these research questions should target the needs of regulators.
14. Additional resources
    a. Identify other sources of information on the species, such as INHS or NatureServe species profile pages.
    b. Also identify spatial information that may be relevant to the species/habitat such as National Wetland Inventory (http://www.fws.gov/wetlands/Data/Mapper.html) or NRCS soil maps (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx).
15. References
    a. References that provide supporting evidence need to be identified. References should be mentioned throughout the document. Experimental and experiential info can be included but it should be identified as such.

Job 5. Develop a template with instructions for producing conservation guidance documents.

We compiled the necessary elements for conservation guidance in Job 4. In addition, we reviewed the format of species documents from Minnesota, Wisconsin, and Michigan, and spoke with professionals at Wisconsin DNR, Minnesota DNR, and Michigan DNR to learn about their experience producing and using species guidance/profiles/abstracts. We developed a template, which describes the elements, to be used to produce a set of complementary documents. As draft guidance documents were produced and reviewed by stakeholders and species experts, their comments have provided additional information on how to better format the template and the template has been revised to reflect these insights. The draft template can be found in the Appendix 2. We will continue to revise and improve the template throughout the project.

Job 6. Select five target species for conservation guidance documents

We collected data on the number of requests of consultation by species and the number of applications for Incidental Take Authorization (Table 2). In addition, we considered the funds used for this project, taxonomic diversity, and the current availability of guidance information to select species that would be top priority for guidance document production. We will be producing guidance documents for: Blanding's turtle, Illinois chorus frog, Yellow-headed blackbird, King rail, and Indiana crayfish. In addition, taxonomic experts have been recruited to

produce draft guidance documents for bat, mussel, and fish species indicated in Table 2. For these species, we will facilitate review and synchronize final drafts. Regal fritillary butterfly, Franklin's ground squirrel, plains hog-nosed snake, and ornate box turtle also merit immediate species guidance production.

Job 7. Produce five conservation guidance documents.
A draft Illinois Chorus frog guidance document (Appendix 3) and a list of 44 species experts/stakeholders was developed. The document was sent out for review; comments and suggestions were received from 19 expert/stakeholders. A list of reviewers contacted and providing feedback can be found in Table 3. A draft of the Blanding's turtle document has been produced, and we are working with the Blanding's turtle recovery team to conduct a preliminary review and compile a list of reviewers. Work is ongoing.

Job 8. Review ITA related regulations and documents.
Endangered Species Act and Administrative Rules have been reviewed to identify legal requirements of conservation plans. In addition, conservation plans and incidental take authorizations were reviewed (Job 2), stakeholders were interviewed (Job 3), and participant observation with the endangered species program was preformed to identify typical shortcomings of conservation plans and information that will improve review of plans. Below (in bold**)** is the legally mandated requirement of a conservation plan from the administrative code Illinois Administrative Code Title 17, Chapter 1, Subchapter c, Section 1080.10. Additional comments (non-bold) clarify what is needed for more robust conservation plans and project assessment.

A conservation plan submitted to the Department's Office of Resource Conservation as the application for authorization for incidental taking of an endangered or threatened species shall , at a minimum, include:

1) **A description of the impact likely to result from the proposed taking of the species that would be covered by the authorization, including but not limited to:**
    a. **legal description, if available , or detailed description including street address and map of the area to be affected by the proposed action and indicia of ownership or control of affected property;**
        i. In addition a GIS shapefile and photos of the area will facilitate assessment of the project.
    b. **biological data on the affected species ; on request of the applicant, the Department shall provide biological data in the Department's possession on the affected species;**
        i. If applicable, attach survey reports completed for the project.
        ii. IDNR may provide the number of species records in the Natural Heritage Database

iii. Include relevant information on the species life history needs and habitat characteristic as they apply to the project. For example, What habitat characteristics are found at the project site? Are there host species on site?

c. description of in taking of species; and the activities that will result an endangered or threatened

i. Describe practices to be used in layman's terms and a timeline of proposed activities

ii. Consider all potential impacts such as noise, vibration, light, predator/prey alterations, habitat alterations, increased traffic, etc

iii. Include any permitting reviews, such as a USFWS biological opinion or USACE wetland review.

d. **explanation of the anticipated adverse effects on listed species.**

i. Describe how will the proposed actions will impact the species. Be sure to address each life cycle stage.

ii. Include information on the species life history strategy (life span, age at first reproduction, fecundity, recruitment, survival) to indicate the most sensitive life history stages (reference on life history strategy)

iii. Identify where there is uncertainty, place reasonable bounds around the uncertainty, and describe how the bounds were determined. For example, indicate if it is uncertain how many individuals will be taken, make a reasonable estimate with high and low bounds, and describe how those estimates were made.

2) Measures the applicant will take to minimize and mitigate that impact and the funding that will be available to undertake those measures, including, but not limited to:

a. plans to minimize the area affected by the proposed action, the estimated number of individuals of an endangered or threatened species that will be taken and the amount of habitat affected;

i. Provide an estimate of the area of each habitat type effect.

b. plans for management of the area affected by the proposed action that will enable continued use of the area by endangered or threatened species;

i. How will suitable habitat be maintained or re-established. For example, native species planting, invasive species control, use of other best management practices, restored hydrology, etc.

c. description of all measures to be implemented to minimize or mitigate the effects of the proposed action on endangered or threatened species ;

i. Avoidance measures include working outside the species' habitat.

ii. Minimization measures include timing work when species is less sensitive or reducing the project footprint.

iii. Mitigation is additional beneficial actions that will be taken for the species such as needed research, conservation easements, propagation, habitat work, or recovery planning.

iv. It is the applicant's responsibility to propose mitigation measures. IDNR expects applicants to provide species conservation benefits 5.5 times larger than their adverse impact.

d. plans for monitoring the effects of measures implemented to minimize or mitigate the effects of the proposed action on endangered or threatened species ;

i. For example, species and habitat monitoring before and after construction include a plan for follow-up reporting to IDNR.

ii. Monitoring surveys should be targeted at reducing uncertainty identified in section 1 d

e. adaptive management practices that will be used to deal with changed or unforeseen circumstances that affect the effectivenesss of measures instituted to minimize or mitigate the effects of the proposed action on endangered or threatened species ; and

i. Adaptive management is a way to make decisions in the face of uncertainty by monitoring the uncertain element over time and adjusting to the new information. Adaptive management requires identifying objectives and uncertainties, thinking through a range of potential outcomes, developing triggers that will lead to different actions being taken, and monitoring to detect those triggers.

ii. Consider environmental variables such as flooding, drought, and species dynamics as well as other catastrophes. Management practices should include contingencies and specific triggers. Note: Not foreseeing any changes does not quality as an adaptive management plan.

a. verification that adequate funding exists to support and implement all mitigation activities described in the conservation plan. This may be in the form of bonds, certificates of insurance, escrow accounts or other financial instruments adequate to carry out all aspects of the conservation plan.

3) A description of alternative actions the applicant considered that would not result in take, and the reasons that each of those alternatives was not selected. A "no-action" alternative shall be included in this description of alternatives.

a. Consideration of alternative actions is an important tool in conservation planning as it allows for thinking of other options and evaluating the potential outcomes in terms of all relevant objectives. However, to be useful it requires creativity in developing alternatives, and systematic analysis in evaluating the alternatives.

b. In evaluating alternatives, describe the economic, social, and ecological tradeoffs of each.

4) **Data and information to indicate that the proposed taking will not reduce the likelihood of the survival of the endangered or threatened species in the wild within the State of Illinois , the biotic community of which the species is a part or the habitat essential to the species existence in Illinois .**

5) **An implementing agreement, which shall include, but not be limited to:**
    a) **the names and signatures of all participants in the execution of the conservation plan;**
    b) **the obligations and responsibilities of each of the identified participants with schedules and deadlines · for completion of activities included in the conservation plan and a schedule for preparation of progress reports to be provided to the Department;**
    c) **certification that each participant in the execution of the conservation plan has the legal authority to carry out their respective obligations and responsibilities under the conservation plan;**
    d) **assurance of compliance with all other federal, State and local regulations pertinent to the proposed action and to execution of the conservation plan; and**
    e) **copies of any final federal authorizations for a taking already issued to the applicant, if any.**

Job 9. Produce conservation plan form and instructions.

Document review (Job 2) stakeholder interviews (Job 3), and review of regulations (Job 9) has improved our understanding of conservation planning for incidental take authorization. Participant observation with the Endangered Species Program and Blanding's turtle recovery team was also used to identify needs. A workshop was attended to learn about dealing with uncertainty using a structured decision making approach. A draft conservation plan form has been created (Appendix 4) based on the information collected and is being used. This form will be continually revised as the project progresses. This work is ongoing.

Job 10. **Complete final report to FWS and IDNR.**

Four Quarterly Reports and this annual report were prepared.

References

Martin, T. G., Burgman, M. A., Fidler, F., Kuhnert, P. M., Low-Choy, S., McBride, M. and Mengersen, K. (2012), Eliciting Expert Knowledge in Conservation Science. Conservation Biology, 26: 29–38.

Morgan, M.G. 2014. Use (and abuse) of expert elicitation in support of decision making for public policy. PNAS 111(20): 7176–7184

Nie, M. A. and Schultz, C. A. 2012. Decision-Making Triggers in Adaptive Management. Conservation Biology, 26: 1137–1144.

Strauss, A. and J. Corbin. 1990. Basics of qualitative research. Newbury Park, CA: Sage.

Table 1
Interview questions (Job2)

Introduction to interview: "Thank you for taking the time to participate in this research to help improve conservation guidance in Illinois. We are trying to gain an understanding of the approach and resources used by various stakeholders and their experiences with the environmental review process This not an assessment of IDNR employee performance, and the results of this work will not be used in that capacity. The end goal of the project is to improve conservation guidance and to create species specific documents providing stakeholders with the information they need to best avoid, minimize, and mitigate impacts. Participation in the interview is voluntary and you may choose to end the interview at any time. All of your responses will be kept confidential within reasonable limits."

1.	How long have you held your position?
2.	What is your highest degree? In what field?
3.	Simply stated, what is the goal of your work?
4.	What are the challenges or issues you face in achieving this goal?
5.	How many ITAs have you played a part in? Estimate if necessary.
6.	Can you describe all of the steps of the process, starting with planning for the project to completion of the project? Please include what your role is in the process?
7.	How much organizational guidance vs personal/ professional discretion are you given in this process?
8.	In general, does the "consultation and incidental take process" do an adequate job of protecting listed species?
9.	What works well in the process or what the strengths of the process?
10.	What doesn't work well in the process or what are its weaknesses?
11.	How important is public perception and input?
12.	What sources of information and data do you use in the environmental review process?
13.	In an ideal world what would you like to know about a species and a project before making a determination?
14.	How much of that information is missing from scientific knowledge?
15.	Has scientific research provided adequate information for your work?
16.	How do you handle risk and uncertainty?
17.	In general, is the regulatory community knowledgeable about environmental impacts?
18.	In general, is the regulated community knowledgeable about environmental impacts?
19.	Describe a good environmental review experience you have had.
20.	Describe a bad environmental review experience.
21.	Does your organization focus more on environmental outcomes or following proper procedures?
22.	Do you have any additional comments or concerns about that we have not discussed that you would like to share?

Table 2. (Job 6) Species list indicating the number of consultations between 2010-2014, number of applications for Incidental Take Authorization through 2015, and project funding. Highlighting indicates species guidance documents being drafted for this project (red), being coordinated by this project (orange) and other high priority species (green).

Common Name	Consultation Hits 2010-2014	Initiated ITAs thru 2015	Fund
Blanding's Turtle	1948	14	
Black-Crowned Night Heron	1713	1	
Yellow-Headed Blackbird	1612	1	X
Least Bittern	1532	1	
Common Moorhen	1208	0	
Black Sandshell	1138	23	
Peregrine Falcon (delisted)	998	1	
Black Tern	745	0	
River Redhorse	548	10	
Loggerhead Shrike	547	3	
Slippershell	421	16	
Iowa Darter	421	3	
Upland Sandpiper	394	2	
Indiana Bat	390	6	
Butterfly	386	8	
Barn Owl	366	2	
Spike	351	7	
Gravel Chub	327	1	
Starhead Topminnow	320	2	
Purple Wartyback	284	9	
King Rail	283	1	X
Franklin's Ground Squirrel	258	5	
Greater Redhorse	258	5	
Hine's Emerald Dragonfly	253	3	
Timber Rattlesnake	246	4	
Yellow-Crowned Night Heron	242	1	
Banded Killifish	233	3	
Blackchin Shiner	233	1	
Rice Rat (delisted)	229	6	
Lake Sturgeon	225	0	
Northern Harrier	224	3	
Little Blue Heron	215	1	
Kirtland's Snake	207	5	
Ornate Box Turtle	205	6	
Black-Billed Cuckoo	196	3	
Higgins Eye	195	3	
Short-Eared Owl	188	3	
Ebonyshell	181	1	
Swainson's Hawk	181	0	
Western Sand Darter	174	2	
Osprey	173	0	
Eastern Massasauga	171	6	
Sheepnose	160	5	
Salamander Mussel	159	0	
Wavy-Rayed Lampmussel	156	6	
Blacknose Shiner	152	0	
Ironcolor Shiner	150	1	

Common Name	Consultation Hits 2010-2014	Initiated ITAs thru 2015	Fund
Black-Crowned Night-Heron	148	1	
Eastern Sand Darter	146	2	
Mississippi Kite	141	1	
Weed Shiner	140	1	
Little Spectaclecase	138	6	
Bluebreast Darter	135	3	
Spectaclecase	117	1	
Pallid Shiner	111	4	
Cerulean Warbler	110	0	
Wilson's Phalarope	110	0	
Bigeye Chub	109	3	
Spotted Turtle	108	2	
Eryngium Stem Borer	101	1	
Regal Fritillary	96	8	
Bigeye Shiner	96	3	
American Bittern	92	0	
Common Moorhen	87	1	
Bald Eagle	86	2	
Mudpuppy	84	2	
Bigclaw Crayfish	83	0	
Forster's Tern	83	0	
Redveined Prairie Leafhopper	83	0	
Golden Mouse	82	0	
Longnose Sucker	82	0	
Southeastern Myotis	80	0	
Illinois Chorus Frog	78	20	X
Indiana Crayfish	78	7	
Common Tern	76	0	
Pugnose Shiner	75	1	
Sandhill Crane	74	3	
Plains Hognose Snake	0	6	
Yellow Mud Turtle	0	5	
Gray Bat	0	4	
Great Plains Ratsnake	0	3	
Illinois Cave Amphipod	0	2	
Snuffbox	0	2	
Fat Pocketbook	0	2	
Kidneyshell	0	2	
Purple Liliput	0	2	
Rainbow	0	2	
Least Tern	0	1	
Coachwhip	0	1	
Flathead Snake	0	1	
Kentucky Crayfish	0	1	
Ottoe Skipper	0	1	
Cobweb Skipper	0	1	
Rabbitsfoot	0	1	
Northern Long-Eared Bat	0	0	

Table 3. (Job 7) Stakeholders who were given the opportunity to comment on the first draft of the Illinois Chorus Frog guidance document.

Name	Role	Feedback received?
Mark Phipps	IDNR-ORC	yes
Scott Ballard	IDNR-ORC	yes
Michelle Simone	IDNR-ORC	yes
Mark Gutersloh	IDNR-ORC	
John Wilker	IDNR-ORC	
Ray Geroff	IDNR-ORC	yes
Bob Szafoni	IDNR-ORC	
Eric Smith	IDNR-ORC	yes
Tim Kelly	IDNR-ORC	
Andrew Hulin	IDNR-ORC	
Bob Bluett	IDNR-ORC	yes
Bryan Eubanks	IDNR-ORC	
Tom Lerczak	INPC	yes
Kelly Neal	INPC	
Debbie Scott Newman	INPC	
Keith Shank	IDNR-OREP	yes
Rich Lewis	IDNR-OREP	
Pat Malone	IDNR-OREP	yes
Nathan Grider	IDNR-OREP	yes
Sheldon Fairfield	IDNR-OREP	
Natalia Jones	IDNR-OREP	
Endangered Species Protection Board	ESPB	
Leon Hinz	Academic	yes
Chris Phillips	Academic	yes
John Tucker	Academic	
Mike Dreslik	Academic	
Malcom McCallum	Academic	
Stanley Trauth	Academic	yes
Bradley Cosentino	Academic	
Richard Essner	Academic	yes
Friends of Sangamon Valley	land manager	yes
Great Rivers Land Trust	land manager	
US Fish and Wildlife Service-Chautauqua	land manager	
US Fish and Wildlife Service-Rock Island	FWS-ES	
Heartlands conservancy	land manager	yes
Eric Golden	SWCD	yes
Tom Brooks	IDOT	

Sue Hargrove Dees	IDOT		
Felecia Hurley	IDOT	yes	
Janel Veile	IDOT		
Vincent Hamer	IDOT		
Bryan Wagner	Tollway		
Jeff Frantz	consultant		
Brian Smith	consultant	yes	
Total		**44**	**19**

Appendix 1
Sources of Information Survey

Survey on staff information sources

* Required

1. **What division/section of IDNR do you work in? ***

2. **Are you field or program staff? ***
   Mark only one oval.
   - ◯ Field staff
   - ◯ Program staff
   - ◯ Field-based regional
   - ◯ Other: _____

3. **What year did you start working at IDNR?**

4. **In the past year, how often did you acquire new information in your field from the following sources? ***
   Mark only one oval per row.

	Never	Once or twice a year	Once or twice a month	Once or twice a week	More than twice a week
Manuals	◯	◯	◯	◯	◯
Supervisors	◯	◯	◯	◯	◯
Review literature	◯	◯	◯	◯	◯
Colleagues	◯	◯	◯	◯	◯
Primary scientific literature	◯	◯	◯	◯	◯
Conferences	◯	◯	◯	◯	◯
Webinars	◯	◯	◯	◯	◯
Workshops	◯	◯	◯	◯	◯
Reports	◯	◯	◯	◯	◯

5. **Please specify additional sources:**

6. **How much of your knowledge and expertise would you say you learned from personal experience rather than these sources?** *

Mark only one oval.

- 0-20%
- 21-40%
- 41-60%
- 61-80%
- 81-100%

7. **What is your preferred source of scientific information?**

Mark only one oval.

- Workshops
- Manuals
- Review literature
- Conferences
- Reports
- Primary scientific literature
- Colleagues
- Supervisors
- Webinars
- Other: .....

8. **How important or unimportant are new developments in your field to your division's work?** *

Mark only one oval.

- Not important
- A little important
- Moderately important
- Very important
- Extremely important

9. **How important or unimportant are new developments in your field to your day to day work?** *

Mark only one oval.

- Not important
- A little important
- Moderately important
- Very important
- Extremely important

10. **How important or unimportant is interdisciplinary knowledge in your day to day work?** *

That is, knowledge outside your specialized field of fisheries, wildlife, ecology, etc.
Mark only one oval.

- Not important
- A little important
- Moderately important
- Very important
- Extremely important

11. **Do you experience any obstacles in acquiring new information?**

For example, travel restrictions, no time during work hours.

12. **Do you have access to primary scientific literature?** *

Mark only one oval.

- Yes, it's readily accessible
- Yes, but it is time consuming to access
- I have access to some journals
- No, I don't have access
- I don't know, I've never tried

13. **How capable do you feel of interpreting primary literature?** *

Mark only one oval.

- I fully understand the nuances
- I usually understand the main message
- I often lose the message in the details
- I don’t read primary literature

14. **Comments**

Appendix 2
Draft Species Conservation Guidance Document-Template

Conservation Guidance for

Common name

Species name (sp author)

IL status:

US status:

Global rank:

From IUCN

Trend:

From IWAP or IUCN

Family:

Habitat:

Similar species:

What species look similar

Phenology:

Depict this as a pictograph showing months and habitat

*Note: Include references when possible. Indicate when evidence is available versus professional judgment is used. Ideally information will be species specific but when it is not available information on closely related species will be used. Try to include pictures of species and habitat and any other measure that will be easier to understand with a picture. Credit the photographer

Species information

Characteristics

a) Physical description of the species similar to description in a field guide with field cues. It should include key identification traits and how can you tell look-a-likes apart. It should include a photo or illustration.

Distribution, Taxonomy, and Status

a) Species distribution on a large scale is readily available via organizations such as NatureServe or IUCN and should be shown on a range map. Information on state distribution can be shown by mapping records from the Natural Heritage database; the point locations should be enlarged so as to conceal potentially sensitive information. If there are different winter and summer ranges this should be described. Do we know what limits their range?

b) Some species will be divided into subspecies and differentiation should be described, physically and geographically. If the species has multiple scientific names proposed, describe them (See the Integrated Taxonomic Information System). Indicate which one is used by the Illinois Endangered Species Protection Board

c) What is the global IUCN status of the species? What is the statewide status and why? If it is possible indicate local population sizes.

Habitat

a) Description of habitat characteristics including biotic and abiotic factors. Describe the environment where the species has been found, including perhaps less than ideal environments such as those in Natural Heritage Database record descriptions. If known, habitat limitations should be indicated. Are there different habitat requirements at different life stages?

b) If possible provide of map of a habitat model such as created by IDNR or from the USGS Gap analysis: http://gapanalysis.usgs.gov/species/data/download/.

Species biology

a) Does the species migrate or move between habitats? When? Why? How far do they move (typical and maximum)? What is a typical, large, and small home range size? What effects home range size? Do they show site fidelity?

b) What is the timing of various life events and how are they triggered?
c) What is their reproductive cycle/system? Indicate when and where certain activities take place.
d) How do they overwinter?
e) Diet - What do they eat? Does it vary by life stage?
f) What are the population dynamics? Indicate specific fecundity, recruitment, mortality, and longevity rates. Include population age and sex structure. What is the first age at reproduction? Have there been population viability studies? What life stage drives population trends?
g) What is the natural community the species is commonly found in? What other species are often found with this one or are characteristic of the habitat where it is found. Do they exhibit inter or intra species territoriality? What are their predators/prey?

Conservation/Management

Species threats

a) Include information on general threats to the species. If possible, indicate the significance of each threat. Consider threats such as habitat loss, invasive species, predators, parasites, diseases harvest, pollution (sounds, light, and chemical), etc. Include anticipated climate change impacts, which may be found in: "Adapting Conservation to a Changing Climate: An Update to the Illinois Wildlife Action Plan"
b) Describe threats due to development project impacts. For example, is the species susceptible to road mortality, erosion, sedimentation, noise pollution, soil compaction, structure collision, shadow flicker, etc.
c) Identify the types of impacts due to past INDR Incidental Take Authorizations. Information can be found in the IDNR ITA database.
d) Provide information on species sensitivity, such as what the species perceives including noise, chemical, and light pollution.

Regulations

a) Identify regulations that apply to the species. This will likely be similar for most Illinois listed species. Describe ITA, possession permits, research permits, scientific collector permits, consultation, etc.

Conservation efforts

a) What has been done to conserve the species? Describe current efforts such as recovery plans, land protection, propagation efforts, research projects, etc. Who is working on these projects?
b) Goals- Have goals been identified for the species? Are there delisting triggers?

Monitoring and Survey Guidelines

a) Identify different survey objectives, such as determining presence/absence, estimating population size, evaluating project impacts, or assessing habitat. Describe specific methods and effort required for different survey objectives. What are the detection rates of these survey methods? How much survey effort is required to acquire 90% confidence? How many years/sites need to be included in surveys? What is the best time of year to conduct surveys? Include references that document methods

Stewardship recommendations

a) How do you maintain or enhance habitat for this species? If prescribed burning is recommended include date or weather restrictions. What structure or dietary needs can to be managed for? Are there host species that should be increased? Are there specific metrics, such as water quality, that can be targeted? Are there invasive species and predators that may need to be controlled?

Avoidance measures

a) How can impacts to the species be avoided? Describe habitat avoidance or other measures that are shown to be affective or may have merit.
b) Note: Timing of habitat destruction will minimize impacts, not avoid them.

Minimization measures

a) How can impacts to the species be minimized? Describe practices or timing that reduces impact to the species. If possible, provide information on the effectiveness of these measures. If possible, include estimated costs of measures.
b) Identifying date restrictions for different types of activities in different locations, such as tree clearing or dewatering. Temperature restrictions may be more appropriate and should be described, yet they may be considered impractical for project developers to manage.
c) Include practices from past ITAs, such as educating site personnel about the sensitive species, limiting project activities to less sensitive seasons, altering project structure/operation to incorporate species needs, relocating or excluding the species from the project site, erosion and sediment control, and preventing the spread of invasive species.

Mitigation and Conservation Opportunities

a) Provide suggestions of conservation actions that will benefit the species. If a recovery plan has been developed, include the identified actions. Actions may include land protection, restoration, propagation, research projects, producing a recovery plan, or invasive species management. If possible, include estimated costs of various efforts
b) Identify conservation groups that work in the area of the species that could be potential partners, including federal, state and local government conservation groups. Check the Prairie State Conservation Coalition website for land trusts. Request permission prior to identifying groups on the document.

Research needs

a) Most of the research gaps should be identified in researching the previous sections and can then be compiled here in the form of questions. Although there may be basic research questions about the species, these research questions should target the needs of regulators.

Additional information

a) Identify other sources of information on the species, such as INHS or NatureServe species profile pages.
b) Also identify spatial information that may be relevant to the species/habitat such as National Wetland Inventory (http://www.fws.gov/wetlands/Data/Mapper.html) or NRCS soil maps (http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx).

References

a) References that provide supporting evidence need to be identified. References should be mentioned throughout the document. Experimental and experiential info can be included but it should be identified as such.

Citation and Acknowledgements

a) Illinois Department of Natural Resources. 2016. Conservation Guidance for (species name).
b) Acknowledge individuals responsible for: compiling information, reviewing draft, and editing document.

Appendix 3
Draft Illinois Chorus Frog Guidance Document

Illinois Chorus Frog

Pseudacris illinoensis (Smith)

IL status:
Threatened

US status:
Under review

Global rank:
G5T3 - Vulnerable

Family:
Hylidae

Habitat:
sand prairie, sandy old fields, ephemeral pools, ditches, flooded depressions

Similar species:
Upland chorus frog, Western chorus frog

Phenology

Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Calling:
Breeding pond: Blue
Terrestrial/underground: Green

Species information

Characteristics

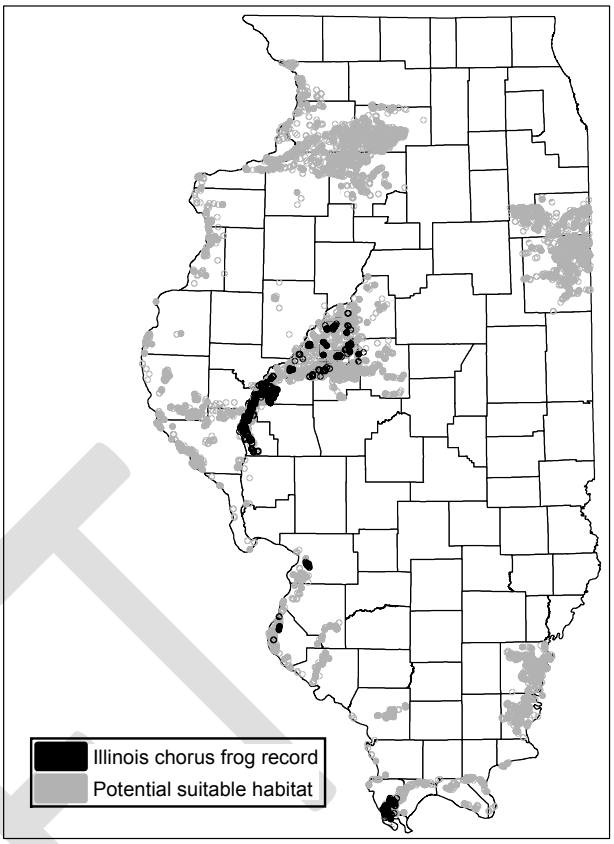
Photo by John Tucker

The Illinois chorus frog (ICF) is a small (1.4 to 1.75 inches long and about 5 grams) tan to gray frog (Philips et al. 1999). Its body is stout and toad-like with robust forearms. Its skin is granular rather than smooth. It has dark brown or black lines on its back with a white belly. It has a characteristic **dark mask-like stripe from snout to shoulder, a dark spot under each eye, and a V- or Y-shaped mark between the eyes.** The throat (vocal pouch) of male ICF darken during the breeding season. The males' breeding call is a series of **high-pitched, rapid, birdlike whistles** that can be heard as much as 1.3 mile away (Brown and Rose 1988). ICF are rarely seen as they spend most of their lives underground emerging only during the breeding season.

Distribution, Taxonomy, and Status

The taxonomic status of the Illinois chorus frog and Strecker's chorus frog (*P. streckeri*) has been debated in the literature. The principle range of *P. streckeri* is from central Texas and adjacent Louisiana through Oklahoma to extreme south-central Kansas and over to central Arkansas. There are a few disjunct populations in west-central and southwestern Illinois, southeastern Missouri and adjacent Arkansas of what has been considered the sub-species *P. streckeri illinoensis* (Trauth et al. 2007). Collins (1991) proposed *P. illinoensis* as a separate species due to its allopatric distribution and morphological distinctions. However, recent work has shown *P. s. illinoensis and P. s. streckeri* are not genetically divergent and the disjunct populations have only recently separated from the Texas populations (Barrow et al. 2015). Still morphology varies geographically *(*Trauth et al. 2007). The International Union for Conservation of Nature recognizes a single species, *P. streckeri*, with disjunct populations (http://www.iucnredlist.org/details/55898/0). The Integrated Taxonomic Information System recognizes both *P. streckeri* and *P. illinoensis* as valid species (ITIS 2015). In Illinois, the ICF was recognized as *P. s. illinoensis* until the 2009 revision of the endangered and threatened species list,

when it was listed as *P. illinoensis* (Title 17 Illinois Administrative Code, Part 1010).



ICF populations are restricted to Missouri, Arkansas, and Illinois, where it is locally abundant in some sand prairies. In Illinois, ICF occurs in three widely separated sandy floodplain regions with the northern and southern populations being genetically distinct management units (Barrow et al. 2015). The northern region covers the largest area; it occurs along the east side of the Illinois River in the central portion of the state from Tazewell County in the north to Scott County in the south and west to Logan County. The central region near the Mississippi River in Monroe and Madison counties has been greatly reduced to an area of roughly 100 ha in Madison County, largely due to loss of non-breeding habitat (Tucker 1998). The Monroe County populations have not been observed since 1999 despite survey efforts, and it is thought that populations might have been extirpated by extensive flooding of the Mississippi River during the 1990's (Brandon and Ballard 1998). The southern region near the junction of the Ohio and Mississippi Rivers in extreme southern Illinois in Alexander county has multiple breeding ponds in the area around Horseshoe Lake Conservation Area where over a thousand ICF have been heard calling (Division of Natural Heritage 2015).

The extent of occurrence and changes in abundance are difficult to gauge based on the temporal, spatial, and methodological limitations of past studies. Recent efforts at modeling ICF habitat have identified additional potential suitable habitat using geographic data on sandy soils, groundwater movement, ponds, and hydric soil (Hinz et al. 2011). IDNR has identified 946 potential breeding sites and 504 sections (standard unit for land surveys, one square mile area) with potential suitable habitat for ICF across six counties (Hulin et al. 2015). The ability to predict exact locations of ICF records is poor (54%), but the larger scale section model agrees well with ICF records (91%, Hulin et al. 2015). This may be due to the varying suitability of breeding ponds between years. A pilot ICF monitoring program targeting these sections with suitable habitat found 56% were occupied (Cosentino 2014). A long term monitoring program has been initiated to detect long term changes in occupancy greater than 30-50%.

Habitat

Illinois chorus frog is fossorial, spending most of its life underground near ephemeral breeding ponds (Tucker 1998). ICF emerges after heavy, early spring rains to breed in nearby ponds, flooded fields, wetlands, and stagnant ditches (Beltz 1991). Eggs and larvae develop in these temporary bodies of water, which must be fishless and persist through June to allow breeding and transformation (Tucker 1995, Tucker 1998, Tucker and Philipp 1995b, Brandon and Ballard 1998). ICF have been heard calling from many types of water bodies, including drainage ditches, sand mine pits, flooded depressions in fields, retention ponds, and permanent ponds, but are absent from flowing or large bodies of water (Brown and Rose

Typical ICF breeding pond. Photo by Bob Bluett

1988). Breeding pond suitability varies between years depending on weather. Breeding pond depths have been measured at 10-80 cm (Brandon and Ballard 1998). Ponds must also have emergent or dead vegetation to provide protective cover and suitable structure to secure egg masses (Tucker 1997a, McCallum et al. 2006).

Around 85% of ICF's life is spent burrowed underground in open terrestrial areas with sandy soil (Tucker et al. 2008). ICF is found in loose soils that allow easy burrowing such as sand, loamy sand, or sandy loam (Brown and Rose 1988, see map of distribution of sandy soils). Bare areas (blow outs) or sparsely vegetated areas, such as sand prairies and old fields, provide habitat that allow burrowing as plant roots do not fill the soil (Tucker et al. 1995, Brown et al. 1972). Tucker (1998) found frogs migrating into and out of old field and not using surrounding lawn and agricultural fields, suggesting lawn and agricultural fields do not provide suitable habitat. However, recently transformed froglets have been found burrowing in wheat fields, but survival in such habitats is deemed unlikely (Tucker et al. 1995). Forested habitats are seldom suitable post-breeding habitats but savannas may be suitable (Phillips et al. 1999). As a fossorial feeder, ICF require habitat with adequate soil invertebrates (Tucker and Wilson 2002).

Natural History

Illinois chorus frogs spend most of their life underground, where they dig forward through the sandy soil with their unusually strong forearms, rather than backward with their hind legs like most fossorial amphibians (Brown 1978). Only four ICF burrows have been observed and documented; they were found in April and November in areas free of vegetation (Axtell and Haskell 1977, Tucker et al. 1995). On the surface ICF burrows are oval with a wider than tall opening with a loose sand apron (Tucker et al. 1995). The burrows observed have varied from roughly level (into a hill side) to nearly vertical and in depth between 10-20cm (Tucker et al. 1995, Axtell and Haskell 1977). There is some evidence (surface depressions and lab experiments) that ICF may surface at night, yet very little is known about this behavior (Axtell and Haskell 1977, Brown 1978). No overwintering burrows have been located, but ICF is not freeze tolerant and must therefore burrow below the freeze line to overwinter (Packard et al. 1998). One season of soil temperature monitoring at a Madison county site indicated that ICF must burrow at least 12.5cm below the surface, perhaps as deep at 25cm to avoid freezing (Packard et al. 1998). In a 30cm deep aquarium experiment, ICF was found burrowed between 2 and 23cm deep (Brown et al. 1972). When there is a shallow layer of clay below the upper layer of sandy soil, it will likely limit the depth of ICF burrowing and impede ICF overwintering in that area.

ICF are the only known anuran capable of feeding below ground (Brown and Cima 1998), but surface feeding is also likely (Tucker and Phillip 1995b). ICF diet consists of small insects and burrowing larvae including Lepidoptera (specifically the agricultural pest *Feltia ducens*), Hemiptera (specifically nabids), Coleoptera (specifically curculionids), and Diptera (Tucker and Phillip 1995b, Tolch 1997). Very little is understood about their fossorial behavior and their ability to locate prey items. Although many adult anurans are visual predators, ICF cannot use sight while feeding underground. It is presumed prey are eaten as encountered (Brown 1978) but ICF may be using vibrations or chemical cues to track and detect prey as has been observed in some other amphibians (Jaeger 1978, Narins 1990, Christensen-Dalsgaard and Narins 1993). Interestingly, other fossorial species are known to detect prey species by vibrations from prey movements that are propagated through homogenous course sand, similar to the soil type preferred by ICF (Devetak et al. 2007, Young and Morain 2002).

ICF are among the earliest of Illinois anurans to emerge and call, often while snow is on the ground and air temperatures are below freezing in late winter or early spring (February to April, Brown and Rose 1988). ICF emergence often coincides with heavy rainfall (2.5 cm or greater), although it is unknown to what cue triggers the emergence: moisture, temperature, vibration, etc. (Tucker and Philipp 1995b). The emergence of other fossorial anurans has been shown to be triggered by vibrations from spring thunderstorms or ATVs (Brattstrom, and Bondello 1983). ICF may not breed in years without suitable breeding conditions, such as drought. ICF will

forego breeding ponds containing fish (Tucker and Philipp 1995b). Breeding begins soon after emergence and continues irregularly for approximately seven weeks (Brown and Rose 1988).

Breeding males form choruses and call nocturnally to attract females (Owen and Tucker 2006). Most chorus have at least 10 males, which temporarily maintain calling territories with about 1.5m between them (Owen and Tucker 2006). Most males call from water while clasping emergent vegetation keeping their vocal sac above the water line (McCallum et al. 2006). Advertisement calls that attract females have a dominant frequency around 2.2 kHz and can be heard from more than 1 mile away (Owen and Tucker 2006, Brown and Rose 1988). Breeding mostly takes place in the center of ponds with deeper water and further from the shoreline (McCallum et al. 2006). Females approach and swim around the calling male until the male jumps onto and clasps the female's back. The pair then swims around depositing eggs and sperm in small clusters of 10-40 eggs and attaching them to underside of vegetation that is submerged or on the surface of the water (Tucker 1997a, Owen and Tucker 2006). In total, ICF lay clutches of around 400-700 eggs (Tucker and Phillip 1995b, Tucker 1997a, Tolch 1997), although Butterfield et al. (1989) found as many as 1,000 eggs in a reproductive female in Arkansas. Egg masses quickly become covered by silt and debris, perhaps disguising and protecting them (Tucker and Phillip 1995b). No further parental care is given.

ICF eggs likely hatch into tadpoles within a few days. As tadpoles they eat suspended matter, organic debris, algae, plant tissue, and plankton. There is evidence that some ICF tadpoles may be cannibalistic, capable of eating smaller ICF tadpoles when necessary to ensure their metamorphosis prior to breeding ponds drying up (McCallum and Trauth 2001). After about two months, ICF tadpoles undergo metamorphosis into the terrestrial form and disperse from the pond, around late May or early June (Tucker 1995). They have been found as far as 0.9km from their pond of origin (Tucker 1998) and are likely capable of traveling much further but may require habitat corridors to travel. Immature ICF grow rapidly and are capable of breeding after one year of growth (Tucker 1995, 1997b). ICF often do not return to their pond of origin for breeding but disperse across the landscape colonizing other breeding ponds (Tucker and Phillip 1995b). This dispersal and colonization of new breeding ponds is important for the population dynamics of metapopulations in which any one site may be extirpated but may be recolonized by individuals from another nearby site. Site fidelity may develop after the first year of breeding (Tucker 1998). ICF life span is typically 2-3 years but individuals may survive as much as six years (Tucker 2000, Tucker et al. 2008).

Little is known about the population dynamics of this species but a few studies that have been conducted on the Madison county population suggest ICF is not a long-lived species, that the population is small (~400 individuals), and at risk of extinction (Tucker 1998, Tucker and Philipp 1995a). Mark-recapture surveys on the Madison county population have shown annual adult survivorship of about 26% and juvenile survivorship from froglet to adult much lower at 2.8% (Tucker 2000). Egg to tadpole survivorship has not been assessed in the field, but McCallum and Trauth (2001) found ICF egg to tadpole survivorship in captivity of 66%. However, under natural conditions generally only 3-5% of amphibian eggs reach metamorphosis (Boone et al. 2007). In addition, years with unfavorable breeding and transformation conditions may result in zero productivity at individual breeding ponds. One study found recruitment at a Madison County breeding ponds in 8 of 16 years (Tucker et al. 2008). Years of failed reproduction can have a considerable impact on the population of short-lived species such as ICF (Tucker and Phillip 1995b).

Potential predators of ICF include fish, snakes, bullfrogs (Rana catesbeiana), turtles, tiger salamander larvae (*Ambystoma tigrinum*) and smallmouth salamander larvae (*A. texanum*). Invertebrate predators include odonata (mostly Gomphidae and Aeshnidae), coleoptera (Dytiscidae), and hemiptera (Gerridae) (Tucker et al. 2008).

Community Associations

Ornate box turtle (*Terrapene ornata*), Illinois mud turtle (*Kinosternon flavescens*), and western hog-nosed snake (*Heterodon nasicus*) are found in similar habitats as Illinois chorus frog. Other amphibians that may be

found in ICF breeding ponds include American toads (*Bufo americanus*), spring peepers (*Pseudacris crucifer*), chorus frogs (*Pseudacris triseriata*), southern leopard frogs (*Rana sphenocephala*), and eastern spade foot toads (*Scaphiopus holbrookii*), upland chorus frogs (*Pseudacris feriarum*), spotted salamanders (*Amlrystoma maculatum*), Fowler's toads (*Bufo woodhousii*), gray treefrogs (*Hyla versicolor*), and bullfrogs (*Rana catesbeiana*).

Conservation/Management

Threats

Habitat loss is likely the greatest threat to ICF. Only 8 out of 29 population records are under at least partial protection as IDNR owned or managed sites. Agricultural production and other developments are reducing habitat available to ICF. Hydrology has been altered on a large scale with increased drainage eliminating breeding habitat altogether or causing them to dry up before tadpoles have time to undergo metamorphosis. Drainage and precision land-leveling for agriculture has removed or drastically reduced standing water on the landscape (Trauth et al. 2006). The loss of a diversity of wetland habitats that had provided suitable habitat under variable conditions is especially problematic when faced with consecutive drought years with no successful reproduction. Conversely, some temporary wetlands have been dammed creating permanent water bodies that allow fish to survive, making the habitat unusable to ICF (Tucker and Phillip 1995b). There are reports of ICF attempting to breed in flooded agricultural fields, but unless water is retained successful reproduction is unlikely (Tucker and Phillip 1995b).

In addition, cultivation of the surrounding terrestrial habitat has greatly altered the landscape. The alteration and fragmentation of habitat around breeding ponds has likely created population sinks as newly transformed frogs disperse across the landscape into conditions that are not suitable, such as agricultural fields or lawn (Tucker and Phillip 1995b). Yet the continued presence of ICF in agricultural areas that appear to have no remaining suitable habitat (sand prairie, old field) suggests that that agricultural production does not entirely preclude ICF (Bluett 2009), but the impacts of agriculture on the species survival are not known. It may be possible that the timing of the ICF life cycle and farming practices are compatible due to the fact that breeding and transformation may occur outside cultivation areas and high impact agriculture activities may occur when ICF are not in their terrestrial habitat or are burrowed deep enough to avoid impact. Nevertheless, soil compaction and chemical inputs associated with agriculture may have direct impacts on ICF. In addition, any activity that decreases soil biodiversity and abundance, such as intensive soil management and high chemical inputs, reduces prey for ICF (Thiele-Bruhn et al. 2012). More research is needed to better understand the relationship between agricultural production and ICF.

Even areas that are protected may become unsuitable due to habitat degradation from invasive species, lack of stewardship, and fragmentation. Invasive species can alter ICF habitat making it unusable. For instance, woody encroachment of black locust or red cedar into sand prairie openings consolidates soil making it difficult for ICF to burrow. New invasive species are appearing all the time which may have direct or indirect impact on ICF. Even native species, such as bullfrogs and fish, can reduce ICF reproduction if they are introduced to breeding ponds (Phillips et al 1999). The lack of regular disturbance, such as prescribed fire, can lead to an increase in ground cover and loss of the open soil condition preferred by ICF. Fragmentation of habitat, such as by highway construction, reduces dispersal and limits metapopulatuion connectivity, which can result in populations at seemingly suitable habitat being extirpated (Tucker and Phillip 1995a). In recent years there has been numerous linear development projects, such as roads, underground pipelines, and transmission lines, that have crisscrossed ICF habitat and increased fragmentation. Road kills are common around breeding ponds as frogs disperse to terrestrial habitat across roadways.

Pesticides, pharmaceuticals, metals, and other environmental contaminants are known to result in endocrine disruption, infertility, genetic damage, increased susceptibility to disease, and death in wildlife, in general

(Boone at el. 2007). ICF are likely exposed to agricultural chemicals in both their breeding and terrestrial habitats on the agricultural landscape. Waste from hog farms, which are prevalent in Cass and Morgan counties, also have the potential to pollute the soil and water of nearby habitats (Brown and Rose 1988). ICF may also be exposed to increased contaminants from storm runoff in more developed areas. Although considered to be a contributor to global declines in amphibians, the impacts of environmental contaminants on ICF populations are unknown.

There is increasing awareness and concern about the impacts of anthropogenic noise on wildlife (Barber et al 2009), as it has been found to interfere with communication between individuals of the same species such as for locating mates, but also interferes with sounds used to locate prey or detect predators. Traffic noise has been found to reduce female frogs response rate to calling males and the ability of female frogs ability to locate calling males (Bee and Swanson 2007). While some frog species have the ability to adjust their call to deal with noisy environments, other species do not (Lengagne 2008, Parris et al. 2009). Noise and vibrations produced by ATV activity has interfered with cues used by fossorial toads to time their emergence to ensure appropriate environmental conditions (Brattstrom, and Bondello 1983). No studies have been conducted on the impact of noise interference on ICF. However, low and high frequency noises from increasing road density and the development of wind farms within ICF habitat has the potential to interfere with ICF's ability to locate mates and/or prey.

ICF is rated as "Extremely Vulnerable" or "Highly Vulnerable" to climate change due to potential drying of ephemeral pools, exacerbated by fragmented landscapes and increased water demand for irrigation (Walk et al. 2011). ICF reliance on sandy soils essentially restricts them to islands of habitat hindering their ability to move to more suitable areas. An increased reliance on groundwater for irrigation could increase ICF vulnerability due to reduced groundwater fed wetlands. Many amphibians are sensitive to increasing environmental levels of UV-B radiation, which has been found to cause embryonic deformities in *Pseudacris* spp. (Starnes et al. 2000).

Infectious diseases caused by viral, bacterial, water mold, metazoan, trematode, and fungal agents have caused declines in amphibian populations across the globe and are a potential threat to ICF populations (Daszak et al. 1999). Ranavirus, a contagious virus capable of infecting amphibians, reptiles, and fish, has been found in Illinois (Duffus et al. 2015). It is implicated in population declines of frog populations and has been found to cause mortality in *Pseudacris* spp, but impacts specific to ICF are unknown (Miller et al. 2011). Chytrid fungus (*Batrachochytrium dendrobatidis*) is a leading cause of global amphibian declines, and although the chytrid fungus has been in Illinois for over 100 years, it has not been found in *Pseudacris* spp. and its impacts to ICF are unknown (Talley et al. 2015).

Conservation efforts

ICF habitat improvements have been made on state and private lands including creation of breeding ponds, restoration of wetlands, control of invasive and woody species in sand prairie habitats. Newly created breeding ponds have been successfully colonized but the population impacts of these efforts are unknown.

A number of agencies have provided support for ICF habitat work including the Farm Service Agency's State Acres for Wildlife Enhancement (SAFE) program, the Conservation Reserve Program, IDNR, State Wildlife Grant (T62D), and the US Fish and Wildlife Service's (USFWS) Landowner Incentive Program and Partners for Wildlife program.

Survey Guidelines

Calling surveys can be used to determine presence, although calling ICF can be heard at a distance of up to 1.3 miles making it difficult to identify local populations and specific habitat use (Brown and Rose 1988). Detection probability for calling surveys is around 77% at the section level (Cosentino 2014). Two to three surveys should be conducted to determine occupancy, in drought years it is especially necessary to complete 3

surveys (Cosentino 2014). Not all years are suitable for breeding and frog calls may not be heard in such years. ICF can be heard calling February to April in southern IL and March to May in central IL after at least 2.5 cm rainfall (Tucker and Philipp 1996, Brandon and Ballard 1998). Detection probability is greatest earlier in the season and surveys should be completed by mid-April, unless an unusually late calling season occurs (Cosentino 2014). Completing surveys outside the breeding season is not feasible. At times breeding choruses can remain silent for 10 to 15 minutes and then resume calling vigorously (Tucker at el. 2008). Consequently, calling surveys must incorporate extended listening periods even when calls are not initially heard. At a minimum the surveyor must listen at a particular spot for 15 minutes. Surveys should begin at least 30 minutes after sunset and end by midnight to evaluate the most active calling period (Cosentino 2014). Surveys should be conducted under conditions of temperatures above 0˚ C and winds less than 30 km/hr with a lack of heavy rainfall (Hulin et al. 2015). Data recording should include air temperature, humidity, wind speed, presence of moonlight, the number of cars that passed by during the survey, and whether or not anthropogenic noise could be heard. Call surveys can provide information on the presence/absence of a species and call intensity can be classified, but this index does not give a good indication of population size (Tucker 2005). General guidelines for anuran calling surveys can be found in Dorcas et al. (2010).

More intensive survey efforts aimed at catching adults and transforming froglets are necessary to understand population size, reproductive success, population viability, and the impact of habitat alterations. Abundance and survivorship can be determined by mark-recapture surveys that use drift fences and pitfall traps or capture frogs while chorusing. Deposition of eggs and tadpole development can be confirmed by dipnet surveys. Drift fences can be used to determine habitat use by capturing frogs migrating into or out of an area. Specific methods will depend on the information needed.

Surveys to monitor impacts of habitat alterations, such as habitat restoration or Incidental Take Authorization, should follow a before-after-control-impact (BACI) design. Due to the great influence of environmental variability on ICF populations, a control site and multiple survey years are necessary for comparison. Surveys should be conducted for two years prior to impact and for six years after impact to cover the life span of the species. Control sites should be close enough to impact sites to have similar environmental variation but far enough away to be uninfluenced by the impact of concern. Mark-recapture methods should be used to estimate abundance, survival, and recruitment (Donnelly and Guyer 1994). Simple call surveys can only indicate presence and are inadequate for determining impacts. Surveys should be initiated as soon as calling ICF are heard and once per week for the following five weeks. Adults should be captured at choruses and marked using pit tags, toe clipping, or dye marking (Brown 1997). Alternatively, drift fences with pit fall traps can be used to increase capture rates of adults and froglets to incorporate juvenile abundance and survival. Estimates of abundance, survival and recruitment can then be made using the program MARK (White and Burnham 1999).

Stewardship recommendations

Areas known to support ICF or thought to be suitable for ICF should be managed to maintain suitable habitat. Breeding ponds may require stewardship to maintain suitability, and because the ICF juvenile stage has the lowest survival rate, its habitat should be a priority for stewardship efforts (Tucker 2000). Tucker et al. (2008) has suggested that removal of predators from breeding ponds has the greatest potential to positively impact recruitment. Emergent vegetation should be established and maintained. Ideally native vegetation will be available in breeding ponds but invasive species, such as reed canary grass (*Phalaris arundinacea),* may also provide suitable structure for chorus frogs (Holzer and Lawler 2015). The regular mowing of roadside breeding ponds should be prevented. Livestock, which trample vegetation and pollute waters, should be excluded from wetlands. Fish should be prevented from establishing populations in breeding ponds by maintaining ephemeral hydrology, but water should be maintained in ponds through June to allow for metamorphasis. Woody encroachment around some wetland sites may alter the hydrology and cause ponds to dry prior to metamorphosis (Bluett 2009). These sites may be improved through removal of woody species. In some cases,

invasive species may need to be controlled in breeding ponds to prevent filling in or drying of wetlands. If necessary, mechanical and chemical removal of vegetation should follow INPC stewardship guideline (http://www.dnr.illinois.gov/INPC/Pages/INPCManagementGuidelines.aspx). At some sites water retention may require use of a well and pump. Details on the creation of breeding ponds can be found in the mitigation and conservation opportunity section.

In terrestrial areas, control of woody and exotic vegetation and maintenance or establishment of native vegetation may be necessary to prevent sod formation and maintain open soil areas for burrowing. Prescribed burning is an important part of maintaining sand prairie communities and should be conducted in the fall when ICF are underground. If necessary, mechanical and chemical removal of vegetation should follow INPC stewardship guideline (http://www.dnr.illinois.gov/INPC/Pages/INPCManagementGuidelines.aspx). Late-summer to early fall mowing of vegetation appears to maintain terrestrial habitat (Berger et al. 2010). It has also been suggested that agricultural practices are generally compatible with this species needs, in that it prevents woody encroachment and maintains open soil, yet allowing natural vegetation to establish around wetlands and reducing cultivation impacts near wetlands will improve habitat (Bluett 2009).

When pesticides are used, chemicals with lower toxicity or that break down quickly should be given preference in both terrestrial and aquatic habitats. Special attention should be given to the surfactant used in the formulation. Many aquatic species are much more sensitive to the 'inactive' ingredients used with pesticides, such as surfactants, than the pesticide itself (Wagner et al. 2013). Surfactant-free glyphosate can be used on cut stems or a surfactant-free 53.8% glyphosate product can be mixed with the surfactant Agri-Dex, which has a much lower toxicity (Diamond and Durkin 1997, NC PARC 2014).

Because some ICF populations may harbor infectious diseases, it is important to decontaminate oneself and equipment prior to moving between ICF occupied sites. Decontamination requires washing and disinfecting all equipment with a 3% bleach solution (http://fishandboat.com/ais/NEPARC_Disinfection_Protocol.pdf).

Avoidance measures
Due to the secretive nature of ICF, avoidance of impacts to ICF is only possible through complete avoidance of suitable habitat. Ephemeral ponds and other suitable bodies of water and the surrounding terrestrial areas (within 1.5 km) with sandy soil should be avoided.

Minimization measures
If habitat cannot be avoided, timing and practices may minimize impacts. Work in breeding ponds should occur outside the breeding season (late June to January). Work in terrestrial habitats (sandy soil within 1.5 km of a breeding pond) should be conducted during the breeding season when frogs are in aquatic habitats or when the ground is frozen. However, due to the nature of ICF breeding behavior these periods may be unpredictable.

If breeding ponds will be impacted, maintain their ephemeral to semi-permanent hydrology to preserve their suitability. Hydrologic studies may be necessary to understand the impacts of trenching and boring to the existing hydrologic conditions. Maintain isolation of wetlands from larger bodies of water with predatory fish and prevent introduction of predatory fish into breeding ponds.

Amphibian exclusion fencing may reduce the number of ICF entering a construction zone, but their fossorial nature and response to surface activity are not well understood, nor is the effectiveness of this measure. For other frog species, a standard silt fence 90 cm tall, trenched 20cm into the soil and with turn-arounds at the ends to redirect frogs away from the site is believed to reduce access (WDNR 2009). The fencing must be installed when the species is not present (during the breeding season if working in terrestrial area). The interior and exterior of the fenced area should be examined daily to liberate any trapped ICF to suitable habitat. The fence

should be examined daily and its integrity maintained. Alternatively, trapping and relocating ICF to nearby suitable habitat has been used to reduce the number of frogs impacted at a construction site.

Amphibian road mortality can be prevented by as much as 95% by installing permanent barrier walls and culvert systems around high traffic roads (Dodd et al. 2004). Barrier walls and curbing around developments have also been suggested as ways to deter ICF. Reduced speed limits and "Break for Wildlife" signs on roads with ICF mortality have also been proposed as strategies for reducing mortalities.

Work within ICF habitat should avoid the use of heavy machinery to prevent compaction of soil, minimize vegetation destruction, and reduce crushing of subterranean frogs. The area impacted should be reduced as much as possible, and areas that are not to be disturbed should be flagged or fenced to alert construction personnel. Work should be completed when soil bearing strength is highest- when the ground is frozen. Soil under drier conditions also has a higher bearing strength than wet soil and will be less susceptible to compaction. When heavy machinery must be used, mat or corduroy roadways and equipment with low psi tires may minimize soil compaction.

If soil moving and restoration is required, efforts should be made to restore the soil profile.

Erosion and sediment controls should be strictly implemented, monitored, and maintained for the duration of the project. Sediment controls, such as silt fences, straw bale barriers, or filter strips, should prevent eroded sediment from reaching wetlands. Sediment controls should be monitored regularly and after rainfall and maintained for the duration of the project. All disturbed areas should be immediately revegetated to prevent erosion and restored to sand prairie with native vegetation.

General application of pesticides, herbicides, or fertilizers should be prohibited to avoid impacts to ICF. If chemical use is necessary, see the stewardship recommendations section.

Anthropogenic noise and vibrations, such as from traffic or construction activities, should be minimized, especially during the breeding season and the peak calling period (sunset to midnight).

Mitigation and Conservation Opportunities

Protection

Habitat modeling and call surveys have identified ICF populations that occur on unprotected land and may be at risk of habitat destruction. Site protection should consist of both breeding and non-breeding habitat to provide for the needs of both adults and juveniles. Priority should be given to protecting wetlands occupied by or near current ICF records and adjacent to sandy soil. In addition, protection of sites that are intermediate to occupied habitat and corridors that improve connectivity may increase the long term survival of those populations. Priority areas for protection for the Mason/Tazewell county population have been identified by Berger et al. (2010) and may be available from IDNR if appropriate. If appropriate, IDNR may also provide additional information on suitable habitat identified by the ICF habitat model. Additional wetlands and sandy soil locations can be located using the following mapping tools (http://www.fws.gov/wetlands/Data/Mapper.html; http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx).

Land protection may consist of acquisition or conservation easement. Acquired land could be donated to a conservation agency or local conservation organization. Conservation easements may provide a level of protection without acquisition. Illinois Nature Preserves Commission permanently protects high quality areas and habitat for listed species on both private and public lands in the Illinois Nature Preserve System. Conservation easements on agricultural land can also protect ICF habitat through retirement of farmed and prior converted wetlands from agricultural production. Such a program was initiated in the Mason County sand areas with the Farm Service Agency, Natural Resources Conservation Service, and Soil and Water Conservation

District and may provide a useful model to expand ICF conservation on agricultural land. Under this design the cost of protecting 150 acres for 10 years was estimated at $150,000 (Bluett 2009). Conservation organizations that are active in the ICF geographic range include Friends of Sangamon Valley and HeartLands Conservancy, which may be interested in partnering on conservation efforts. Additional conservation organizations can be identified through the Prairie State Conservation Coalition (http://www.prairiestateconservation.org).

Stewardship

Beyond protection of ICF habitat there is considerable stewardship work that may be required to maintain ICF habitat that is already protected. Terrestrial habitat may be maintained by disturbance, such as prescribed fire, so that vegetation does not become too thick and eliminate bare soil or allow the establishment of invasive species. See Stewardship Recommendations section. ICF habitat stewardship opportunities exist on state owned properties, USFWS owned properties, and private properties. One terrestrial habitat restoration project controlled woody and invasive species on 50 acres and established native vegetation on 10 acres for an estimated $20,000 (Bluett 2009).

Restoration

In addition to protection and stewardship of existing habitat, there are opportunities to create additional ICF habitat within its range. Habitat creation should incorporate both breeding ponds and terrestrial habitat (Tucker et al. 2008). New ponds should be located near existing populations (within 1 km) to allow for natural colonization of the site (Tucker et al. 2008). The minimum dimensions of a breeding pond are around 15 ft. across and no more than 3 ft. deep with gradual sloping sides (Szafoni et al. 2002). Constructed ponds must persist until mid-June to provide time for breeding and tadpole development and should not last year round to prevent fish populations from developing. Therefore, hydrologic surveys will be necessary to ensure the created pond will provide suitable conditions. In ideal locations very little excavation is necessary as shallow depressions that will hold water may be suitable and readily restored under the right conditions (McClain et al. 1997). Pond liners have been used to ensure water is retained in some ponds but liners prevent other amphibians from being able to burrow into the sediment and restrict the establishment of aquatic vegetation, making this option less than ideal (Szafoni et al. 2002). Some pond creations have used water control structures or well pumps to ensure suitable water levels are maintained through metamorphosis, but this is often not necessary for ephemeral ponds. Where pond levels are controlled, they should be drained in mid to late June to reduce breeding success of salamander larvae (Tucker et al. 2008). Before creating a pond the water quality at the site should be tested and if contaminants are found they should be remedied to prevent impacts to ICF. Ponds should have dead grasses or other emergent vegetation to act as structure for egg deposition and to provide protection for tadpoles and breeding adults. In ephemeral ponds, terrestrial vegetation that grows after the pond dries can provide this structure but aquatic vegetation, such as arrowhead, spikerush, pickerelweed, wild celery, or bulrush, may also provide structure. One project that restored an existing breeding pond and created another was estimated to cost $19,000 (Bluett 2009). Breeding pond creation practices correspond to National Conservation Practice Standards- Shallow Water Development and Management (NRCS Code 646) and Wildlife Wetland Habitat Management (NRCS Code 644), and Conservation Reserve Program Practice- Non-floodplain Wetland Restoration (CP 23A) and Shallow Water Areas for Wildlife (CP9). For more information on the creation of breeding ponds see Tucker et al. 2008.

For the terrestrial portion of the conservation/mitigation area, creation or restoration of sand prairie habitat should be planned (Tucker et al. 2008). The first step of prairie restorations is generally controlling weeds and invasive species, often with agricultural cultivation (Rowe 2010). Exotic trees, which are often present, should also be removed. Selection of grasses and forbs for planting should be appropriate for the local conditions. Although there is currently no experimental evidence that native vegetation is better for ICF than old-field vegetation, the sand area must support significant subterranean invertebrate populations (Tucker et al. 2008) and restoration of prairie may benefit other organisms. Native vegetation used in ICF habitat restorations has included: grasses such as eastern gamagrass, Virginia wild rye, switchgrass, and big bluestem, and forbs, such as partridge pea, bundleflower, sweet coneflower, blazing star, showy tick trefoil, black-eyed Susan, cup plant, prairie penstemon, sky blue aster, sand coreopsis, Illinois tick trefoil, pale purple coneflower, wild bergamot, pale beardtongue, yellow coneflower, stiff goldenrod, showy goldenrod (Bluett 2009). Broadcast or drill seeding can be used. Ongoing management of the restoration site may be necessary including fall prescribed burns and invasive species control. More information on prairie restoration can be found at: http://dnr.state.il.us/conservation/naturalheritage/prairie/table.htm. Terrestrial habitat creation corresponds to National Conservation Practice Standard- Upland Wildlife Habitat Management (NRCS Code 645).

Restorations need to be monitored to determine success; presence of calling ICF does not indicate success as the newly created habitat may be a sink, attracting frogs to an area in which they cannot survive. Mark recapture and dipnet surveys are necessary to determine survival and reproduction of ICF at the newly restored site.

Research needs

There are also research questions with potential to advance conservation of ICF.

1. What is the viability of ICF populations across Illinois?
2. What are the limiting factors to ICF population growth?
3. What are the fossorial habits of ICF, in terms of spatial ecology, sensory ecology, etc.?
4. What is the relationship of ICF and modern agricultural practices?
5. What is the relationship between ICF and emerging developments, such as wind energy?
6. What are the impacts of environmental contaminants on ICF populations?

Additional information

Websites

http://wwx.inhs.illinois.edu/collections/herps/data/ilspecies/ps_strecke/

http://www.inhs.illinois.edu/animals_plants/herps/species/ps_strecke.html

http://explorer.natureserve.org/servlet/NatureServe?searchName=Pseudacris+streckeri+illinoensis

http://www.amphibiaweb.org/index.html

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Citation and Acknowledgements

Illinois Natural History Survey
Illinois Department of Natural Resources, Division of Natural Heritage
Other contributors?

Appendix 4
Draft Conservation Plan Template

Illinois Department of Natural Resources
CONSERVATION PLAN
(Application for an Incidental Take Authorization)
Per 520 ILCS 10/5.5 and 17 Ill. Adm. Code 1080

150-day minimum required for public review, biological and legal analysis, and permitting

PROJECT APPLICANT:

PROJECT NAME:

COUNTY:

AREA OF IMPACT:

The incidental taking of endangered and threatened species shall be authorized by the Illinois Department of Natural Resources (IDNR) only if an applicant submits a conservation plan to the IDNR Incidental Take Coordinator that meets the following criteria:

1. A **description of the impact likely to result** from the proposed taking of the species that would be covered by the authorization, including but not limited to -

A) identification of the **area to be affected** by the proposed action, include a legal description and a detailed description including street address, map(s), and GIS shapefile. Include an indication of ownership or control of affected property. Attach photos of the project area.

B) **biological data** on the affected species including life history needs and habitat characteristics. Attach all biological survey reports.

C) **description of project activities** that will result in taking of an endangered or threatened species, including practices to be used, a timeline of proposed activities, and any permitting reviews, such as a USFWS biological opinion or USACE wetland review. Please consider all potential impacts such as noise, vibration, light, predator/prey alterations, habitat alterations, increased traffic, etc.

D) explanation of the anticipated **adverse effects on listed species**;

- How will the proposed actions impact each of the species' life cycle stages.
- Include information on the species life history strategy (life span, age at first reproduction, fecundity, recruitment, survival) to indicate the most sensitive life history stages (reference on life history strategy)
- Identify where there is uncertainty, place reasonable bounds around the uncertainty, and describe how the bounds were determined. For example, indicate if it is uncertain how many individuals will be taken, make a reasonable estimate with high and low bounds, and describe how those estimates were made.

2) Measures the applicant will take to **minimize and mitigate** that impact and the **funding** that will be available to undertake those measures, including, but not limited to -

A) plans to **minimize the area affected** by the proposed action, the estimated **number of individuals** of each endangered or threatened species that will be taken, and the **amount of habitat** affected (please provide an estimate of area by habitat type for each species).

B) **plans for management of the area** affected by the proposed action that will **enable continued use** of the area by endangered or threatened species by maintaining/re-establishing suitable habitat (for example, native species planting, invasive species control, use of other best management practices, restored hydrology, etc.).

C) description of **all measures to be implemented to avoid, minimize, and mitigate** the effects of the proposed action on endangered or threatened species.

- Avoidance measures include working outside the species' habitat.
- Minimization measures include timing work when species is less sensitive or reducing the project footprint.
- Mitigation is additional beneficial actions that will be taken for the species such as needed research, conservation easements, propagation, habitat work, or recovery planning.
- It is the **applicants responsibility to propose mitigation measures**. IDNR expects applicants to provide species conservation benefits 5.5 times larger than their adverse impact.

D) plans for **monitoring** the effects of the proposed actions on endangered or threatened species, such as species and habitat monitoring before and after construction, include a plan for follow-up reporting to IDNR. Monitoring surveys should be targeted at reducing uncertainty identified in section 1 d.

E) **adaptive management practices** that will be used to deal with changed or unforeseen circumstances that affect on endangered or threatened species.

- Adaptive management is a way to make decisions in the face of uncertainty by monitoring the uncertain element over time and adjusting to the new information. Adaptive management requires identifying objectives and uncertainties, thinking through a range of potential outcomes, developing triggers that will lead to different actions being taken, and monitoring to detect those triggers
- Consider environmental variables such as flooding, drought, and species dynamics as well as other catastrophes. Management practices should include contingencies and specific triggers. Note: Not foreseeing any changes does not quality as an adaptive management plan.

F) verification that **adequate funding** exists to support and implement all mitigation activities described in the conservation plan. This may be in the form of bonds, certificates of insurance, escrow accounts or other financial instruments adequate to carry out all aspects of the conservation plan.

3) A description of **alternative actions** the applicant considered that would reduce take, and the reasons that each of those alternatives was not selected. A "no-action" alternative" shall be included in this description of alternatives. Please, describe the economic, social, and ecological tradeoffs of each action.

- Consideration of alternative actions is an important tool in conservation planning as it allows for thinking of other options and evaluating the potential outcomes in terms of all relevant objectives. However, to be useful it requires creativity in developing alternatives, and systematic analysis in evaluating the alternatives.
- In evaluating alternatives, describe the economic, social, and ecological tradeoffs of each.

4) Data and information to indicate that the proposed taking **will not reduce the likelihood of the survival** of the endangered or threatened species in the wild within the State of Illinois, the biotic community of which the species is a part, or the habitat essential to the species existence in Illinois.

5) An **implementing agreement**, which shall include, but not be limited to (on a separate piece of paper containing signatures):

A) the names and signatures of all participants in the execution of the conservation plan;

B) the obligations and responsibilities of each of the identified participants with schedules and deadlines for completion of activities included in the conservation plan and a schedule for preparation of progress reports to be provided to the IDNR;

C) certification that each participant in the execution of the conservation plan has the legal authority to carry out their respective obligations and responsibilities under the conservation plan;

D) assurance of compliance with all other federal, State and local regulations pertinent to the proposed action and to execution of the conservation plan;

E) **copies of any final federal authorizations for a taking already issued to the applicant**, if any.

PLEASE SUBMIT TO: Incidental Take Authorization Coordinator, Illinois Department of Natural Resources, Division of Natural Heritage, One Natural Resources Way, Springfield, IL, 62702 OR DNR.ITAcoordinator@illinois.gov **October 2015**